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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/510,599	LECOMTE, MICHEL	
	Examiner	Art Unit	
	JOHANNES P. MONDT	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 February 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *5 and 11-21* is/are pending in the application.

4a) Of the above claim(s) *11-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5 and 15-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/26/08 has been entered.

Response to Amendment

2. Amendment filed with said Request for Continued Examination on 2/26/08 forms the basis for this Office Action. Applicant substantially amended claim11 and has added new claims 20 and 21. In light of the Amendment to claim 11, said claim 11 no longer is drawn to the elected invention and accordingly has been withdrawn, while arguments of applicants are persuasive for the examination of claims 15 and 16 (see below under "Elections/Restrictions" and "Response to Arguments". Accordingly, claims 5 and 15-21 have been examined, claims 11-14 are withdrawn, and claims 14 and 6-10 are cancelled.

3. Comments on Remarks submitted with said Amendment are included below under "Response to Arguments" and under "Election/Restriction".

Elections/Restrictions

4. Applicant's argument in Remarks, submitted with said Amendment, in traverse of withdrawal of claims 15 and 16 are found persuasive. Accordingly, Claims 15 and 16 have been examined.

5. However, the substantially amended claim 11 was found not to be drawn to the invention as elected, because the only "fourth circuit" different from primary, second and tertiary circuits in the invention as recited through claim 11, i.e., as recited through "a moderate temperature heat exchanger having a first portion connected to the secondary circuit [9] for circulation of the second heat exchange fluid in the moderate temperature heat exchanger and a secondary portion connected to a fourth circuit different from the primary [6], secondary and tertiary circuits [10]" (primary circuit =6, secondary circuit = 9, and tertiary circuit =10) is contingent on the inclusion of by-pass circuit 9', being the only circuit additional to the first, second and third circuits; however, bypass circuit 9' is not part of the elected invention (see response filed 9/15/06 to restriction/election requirement mailed 3/24/06). Therefore, claim 11 has been withdrawn from consideration.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. ***Claim 19*** is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for small deviations from pressure equilibration between first and second heat exchange gases, does not reasonably provide enablement for conditions under reactor operation wherein pressure differences can exist between the first heat exchange gas and the second heat exchange gas ordained by the power level of the nuclear reactor. It has to be kept in mind that pressure equalizing not through the exchange of material (fluid) but exclusively through the movement of pistons and in particular without any exchange of gas particles, -which is implicit in the claim language because of the recitation of the pressure equalizing valve and the entirely closed nature of the secondary circuit, is limited to the maximally achievable volume change imparted on first and second heat exchange gases by the piston movements that form the mechanism of operation of the disclosed pressure equalizing valve 20 . Therefore, the specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to enable the invention commensurate in scope with the claim.

8. ***Claim 21*** is rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The value of the pressure of the secondary exchange fluid recovered at the outlet of heat exchanger 16 (see page 15 of the Specification as originally filed) is disclosed as an important determinant of the range of compression ratio as claimed, but not included in the claim(s); and hence the claimed invention defined by claim 21 is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976).

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. ***Claim 19*** is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: the thermodynamic parameters under the claimed "pressure equalizing valve" has the capability to equalize the pressure, given that reactor temperature of the core and of the first and second heat exchange are provided with a range, whilst the volume occupied by said first and second heat exchange gases are not. Neither are the dimensions of the pistons comprised in the valve. Pressure change can only be imparted by causing a volume change, volume and pressure to a good approximation both for gases and steam being related through an inverse proportionality, to which Examiner takes official notice.

11. ***Claim 21*** is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: the pressure of the second heat exchange fluid and its influence determination the range as claimed for the compression ratio.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. ***Claims 5 and 20*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al (GB 2 050 679 A) (see IDS filed 10/12/04; previously cited) in view of Nathenson et al (4,842,054) (previously cited).

Griepentrog et al teach (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1 and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the

reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b) "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive

water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

The following limitations are functional, i.e., limiting intended use but not limiting the claimed device:

(a) "for cooling the core of the reactor";

(b) "heating the second exchange gas on the basis of the heat produced in the reactor core by the first heat exchange gas";

(c) adapted to the use of helium as a first heat exchange gas and of a mixture of helium and nitrogen as a second heat-exchange gas";

(d) "to receive water at the inlet and to provide steam at the outlet to the stem turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine";

Applicant is reminded that a claim containing a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. What is patentable is only the capability for the claimed intended use. See MPEP 2114.

On claim 20: the secondary circuit in Giepentrog et al includes a single compressor 18 capable of recompressing the second heat exchange gas prior to its reintroduction at the inlet of the secondary portion of the intermediate heat exchanger 6 (see page 3, lines 47-58 and Fig. 1).

13. ***Claim 15*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al (GB 2 050 679 A; previously cited and applied to claim 5 above), in view of Nathenson et al (4, 842,054; previously cited and as applied to claim 5 above) and Squires (3,436,909).

Griepentrog et al teach (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1 and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a

gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b) "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

Neither Griepentrog et al nor Nathenson et al necessarily teach the limitation on tertiary circuit, lines 18-28, except that Nathenson et al do teach the limitation on condenser (see condenser 30, Figure 1).

However, it would have been obvious to include said limitation in view of Squires, who, in a patent on an apparatus for combined gas-steam cycle inter alia for a nuclear power reactor (col. 5, l. 15-24, title, abstract and "Summary of the Invention"), hence analogous art, teach "increased efficiency and unusual economy" and in an invention "well suited for use of nuclear heat" (col. 1, l. 25-48) based on the adding of heat to steam between consecutive (steam) turbine expansions in series in turbines along one shaft connected to the electricity generator: see heat exchangers 14, 15 and 16 and steam turbines 3, 4 and 5 (Figure 2) (col. 5, l. 63 – col. 6, l. 42). It would have been obvious to include the teaching by Squires in the Steam Loop by Nathenson et al, and hence in the combined invention, because of the teaching by Squires of increased efficiency. Finally, it would have been obvious to include the limitation that the tertiary circuit is closed because one of ordinary skill in the art would deem it obvious to thereby improve thermal efficiency through the avoidance of high-temperature steam loss.

The following limitations are functional, i.e., limiting intended use but not limiting the claimed device:

(a) "for cooling the core of the reactor";

(b) "heating the second exchange gas on the basis of the heat produced in the reactor core by the first heat exchange gas";

(c) adapted to the use of helium as a first heat exchange gas and of a mixture of helium and nitrogen as a second heat-exchange gas";

(d) "to receive water at the inlet and to provide steam at the outlet to the stem turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine";

(e) "to receive wet steam";

(f) "to heat and dry the wet steam introduced at the inlet of the second portion of the heat exchange heater".

Applicant is reminded that a claim containing a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. What is patentable is only the capability for the claimed intended use. See MPEP 2114.

14. ***Claim 16*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al (GB 2 050 679 A; previously cited and applied to claim 5 above), in view of Nathenson et al (4, 842,054; previously cited and as applied to claim 5 above), Squires (3,436,909) and Werker et al (4,236,968).

Griepentrog et al teach (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1 and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes

official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b)

"a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation

of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

Neither Griepentrog et al nor Nathenson et al necessarily teach the limitation on tertiary circuit, lines 18-28, except that Nathenson et al do teach the limitation on condenser (see condenser 30, Figure 1).

However, it would have been obvious to include said limitation in view of Squires, who, in a patent on an apparatus for combined gas-steam cycle inter alia for a nuclear power reactor (col. 5, l. 15-24, title, abstract and "Summary of the Invention"), hence analogous art, teach "increased efficiency and unusual economy" and in an invention "well suited for use of nuclear heat" (col. 1, l. 25-48) based on the adding of heat to steam between consecutive (steam) turbine expansions in series in turbines along one shaft connected to the electricity generator: see heat exchangers 14, 15 and 16 and steam turbines 3, 4 and 5 (Figure 2) (col. 5, l. 63 – col. 6, l. 42). It would have been obvious to include the teaching by Squires in the Steam Loop by Nathenson et al, and hence in the combined invention, because of the teaching by Squires of increased efficiency. Finally, it would have been obvious to include the limitation that the tertiary circuit is closed because one of ordinary skill in the art would deem it obvious to thereby improve thermal efficiency through the avoidance of high-temperature steam loss.

Although none of the above references teach the limitation on a counter-current heat exchanger as recited in the final six lines of the claim, it would have been obvious to include a heat exchanger being disposed as recited in the claim in view of Werker et al, who teach a pre-heater embodied as a heat exchanger (15) (col. 2, l. 27-34 and l. 59-

62; see Figure) so as to preheat the water input into the steam generator (2) (loc. cit.), while said pre-heater is also used as after-heat removal means (loc.cit.); one of ordinary skill in the art would deem it obvious to feed preheated water rather than cold water to a steam generator for efficiency, for which examine takes official notice. Including the teaching by Werker et al places the pre-heater as heat exchanger just before the inlet to the steam generator and thus meets the claim limitation, on heat exchanger being disposed as recited, in the combined invention as defined by the above combination of Griepentrog et al, Nathenson et al and Squires, while the heat exchanger by Werker et al is necessarily a counter-current heat exchanger as used both for steam-generator-inlet pre-heater and after-heat remover because the inlet stream of water and the steam flow from which after-heat is removed are necessarily counter-flowing when brought together in the same heat exchanger.

The following limitations are functional, i.e., limiting intended use but not limiting the claimed device:

(a) "for cooling the core of the reactor";

(b) "heating the second exchange gas on the basis of the heat produced in the reactor core by the first heat exchange gas";

(c) adapted to the use of helium as a first heat exchange gas and of a mixture of helium and nitrogen as a second heat-exchange gas";

(d) "to receive water at the inlet and to provide steam at the outlet to the stem turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine";

(e) "to receive wet steam";

(f) "to heat and dry the wet steam introduced at the inlet of the second portion of the heat exchange heater"; and

(g) "for returning condensed water to the inlet of the secondary portion of the steam generator".

Applicant is reminded that a claim containing a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. What is patentable is only the capability for the claimed intended use. See MPEP 2114.

15. ***Claim 17 and 18*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al (GB 2 050 679 A; previously cited and applied above to claims 5 and 11) and Nathenson et al (4,842,054; previously cited and as applied above to claim 5 above) in view of Naito et al (4,714,593) (previously cited).

On claim 17: *Griepentrog et al teach* (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1 and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through

the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b) "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion

connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

Neither Griepentrog et al nor Nathenson et al necessarily teach the limitation that the intermediate heat exchanger is a plate exchanger. However, plate heat exchangers have long been in use in the thermal power industry, as witnessed for instance by Naito et al, who, in a patent on heat exchange technology (title, abstract and col. 1, l. 5 – col. 2, l. 26), hence analogous in this regard to Griepentrog et al, teach a plate exchanger as a possible embodiment for heat exchanger 60 (Figures 1B and 5; and col. 9, l. 40-60). Hence all of the components recited in claim 17 are known, the only difference being the combination of old elements into a single device. Thus, it would have been obvious to one of ordinary skill in the art to select a plate exchanger, for instance a plate-fin exchanger, for the intermediate heat exchanger, since the operation of the plate exchanger is in no way dependent upon the operation of the other components, - because heat exchange of fluids with a plate surface or a plate-fin structure is effective regardless the fluid, given the large surface area available for heat exchange with a surface and/or fin, and given that both fluids involved in the intermediate exchanger by Griepentrog et al are characterized with positive thermal conductivity (see Abstract in Griepentrog et al, and see, for instance Chapman and Cowling, "Mathematical Theory of Non-Uniform Gases", 13.2, in particular Table 20 (see experimental values for helium and nitrogen)). Given the exchange gas composition, and the sizable thermal diffusivities of the participating gases, the selection of a plate exchanger is obvious merely considering the large surface area over which the heat exchange takes place. Therefore, the claim would have been obvious because a person of ordinary skill has good reason (large surface area involved in the heat exchange) to pursue known

options (including the tested plate exchanger or plate-fin exchanger) within his or her technical grasp. If this leads to the anticipated success, then it is likely the product not of innovation but of ordinary skill and common sense.

The following limitations are functional, i.e., limiting intended use but not limiting the claimed device:

(a) "for circulation of a second heat-exchange gas on which the gas turbine is inserted";

(b) "heating the second exchange gas on the basis of the heat produced in the reactor core by the first heat-exchange gas";

(c) "adapted to the use of helium as a first heat-exchange gas and of a mixture of helium and nitrogen as a second heat-exchange gas";

(d) "to receive water at the inlet and to provide steam at the outlet of the steam turbine"; and

(e) "to receive the second exchange gas after it issues from the gas turbines".

Applicant is reminded that a claim containing a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. What is patentable is only the capability for the claimed intended use. See MPEP 2114.

On claim 18: Griepentrog et al teach (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1

and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al also teach the secondary circuit being entirely closed (page 2, lines 59-60) and including a compressor (either 14, 16, 18 or any combination thereof may be activated depending on the desired compression ratio; see Abstract and page 3, lines 47-57) *capable of* recompressing the second heat exchange gas to a desired or predetermined pressure level, prior to its reintroduction (page 3, line 55) at the inlet of the secondary portion of the intermediate exchanger. The limitation "substantially equal to the pressure of the first heat-exchange gas" does not carry patentable weight, limiting only the intended use of said compressor. Intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In re Casey,152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b) "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l.

59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

Neither Griepentrog et al nor Nathenson et al necessarily teach the limitation that the intermediate heat exchanger is a plate exchanger. However, plate heat exchangers have long been in use in the thermal power industry, as witnessed for instance by Naito et al, who, in a patent on heat exchange technology (title, abstract and col. 1, l. 5 – col. 2, l. 26), hence analogous in this regard to Griepentrog et al, teach a plate exchanger as

a possible embodiment for heat exchanger 60 (Figures 1B and 5; and col. 9, l. 40-60). Hence all of the components recited in claim 17 are known, the only difference being the combination of old elements into a single device. Thus, it would have been obvious to one of ordinary skill in the art to select a plate exchanger, for instance a plate-fin exchanger, for the intermediate heat exchanger, since the operation of the plate exchanger is in no way dependent upon the operation of the other components, - because heat exchange of fluids with a plate surface or a plate-fin structure is effective regardless the fluid, given the large surface area available for heat exchange with a surface and/or fin, and given that both fluids involved in the intermediate exchanger by Griepentrog et al are characterized with positive thermal conductivity (see Abstract in Griepentrog et al, and see, for instance Chapman and Cowling, "Mathematical Theory of Non-Uniform Gases", 13.2, in particular Table 20 (see experimental values for helium and nitrogen)). Given the exchange gas composition, and the sizable thermal diffusivities of the participating gases, the selection of a plate exchanger is obvious in light of the large surface area over which the heat exchange takes place. Therefore, the claim would have been obvious because a person of ordinary skill has good reason (large surface area involved in the heat exchange) to pursue known options (including the tested plate exchanger or plate-fin exchanger) within his or her technical grasp. If this leads to the anticipated success, then it is likely the product not of innovation but of ordinary skill and common sense.

The following limitations are functional, i.e., limiting intended use but not limiting the claimed device:

(a) "for circulation of a second heat-exchange gas on which the gas turbine is inserted";

(b) "heating the second exchange gas on the basis of the heat produced in the reactor core the first heat-exchange gas";

(c) "adapted to the use of helium as a first heat-exchange gas and of a mixture of helium and nitrogen as a second heat-exchange gas";

(d) "to receive water at the inlet and to provide steam at the outlet to the steam turbine";

(e) to receive the second exchange gas after it issues from the gas turbine"; and

(f) "for recompressing the second exchange gas to a pressure which is substantially equal to the pressure of the first heat exchange gas in the primary circuit of the nuclear reactor prior to its reintroduction at the inlet of the secondary portion of the intermediate exchanger".

Applicant is reminded that a claim containing a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. What is patentable is only the capability for the claimed intended use. See MPEP 2114.

16. ***Claim 21*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al (GB 2 050 679 A) (see IDS filed 10/12/04) in view of Nathenson et al (4,842,054), or, in the alternative, over the foregoing references to Griepentrog et al and Nathenson et al in view of Berchtold et al (3,218,807).

This rejection is offered to the best of examiner's understanding, referring to the rejection under 35 U.S.C. 112, second paragraph, with reference to section 11 above.

As detailed above, claim 5 is unpatentable over Griepentrog et al in view of Nathenson et al. Neither of these references necessarily teach the specific range for the compression ratio as claimed. However, (a) Applicant does not explain why the claimed range (disclosure through page 15 of the original specification) is critical to the invention. Furthermore, referral is made in the disclosure to a value of the pressure of the secondary exchange fluid recovered at the outlet of heat exchanger 16, which is, however, NOT claimed, and therefore, the claimed range is not critical to the invention as claimed. Hence, said range is merely a matter of finding the optimum working conditions by routine experimentation for one of ordinary skill in the art. See MPEP 2144.05 II). Furthermore, even arguendo, (b) it would have been obvious to include said range in view of Berchtold et al, who, in a patent on a power plant utilizing a gas turbine, hence analogous art, teach a compression ratio of up to about 2.5 (see col. 6, l. 3). Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges as claimed overlap the ranges disclosed in the prior art or when the ranges as claimed do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties (See MPEP 2144.05 I).

Response to Arguments

17. Applicant's arguments filed 2/26/08 have been fully considered but they are not persuasive for the following reasons:

a. On the Rejection of Claim 5 under 35 U.S.C. 103(a):

a.1: Counter to Applicant's argument in section 2, page 10, its rejection is neither based on a teaching by Griepentrog of a tertiary circuit, nor on a compatibility of the actual embodiments of heat exchange fluids. The efficiency of the flow coupler (electromagnetic pump) is distinct from the efficiency of the heat exchange system as a whole. What needs to be learned from Nathenson et al, is only the addition of a final, tertiary circuit in the form of a steam cycle 34 (see reference to col. 6, l. 17-25 in said Office Action). The only feature not comprised in Griepentrog et al is the tertiary circuit, while Nathenson et al do teach said tertiary circuit. Whether said steam loop is at the low-temperature end of liquid metal cycles or gas cycles is irrelevant for the motivation because in both cases said steam loop offers an increase in electrical efficiency through reduction of the temperature of the respective metal or gas working fluids, which provides in itself ample motivation to combine the teaching by Nathenson et al with the invention by Griepentrog. See the cited portion on col. 2, l. 62-64 in Nathenson et al. Additionally, see also col. 4, l. 38-47 to witness the key role of the steam in the cooling of the metal working fluid in Nathenson et al. Furthermore, Applicant only provides traverse for a portion of the motivation to combine, because examiner cited also (a) less demanding mechanical design parameters at reduced operating temperatures, and (b)

the advantage of useable energy in its most conventional form, namely: steam, thus being able to drive conventional generators of electricity. Finally, given an overall temperature difference, first principles in thermodynamics would have prompted one of ordinary skill in the art of heat exchange to expect a higher efficiency for processes wherein the temperature differences in each cycle are lower because the most efficient heat cycle imaginable is the Carnot cycle predicated on a reversible process, while it is the temperature difference that drives non-equilibrium, i.e., irreversible, processes (see E. Fermi, "Thermodynamics", Dover Publications, Inc., New York (first published 1936; this edition first published in 1956), especially pages 31-39.

a.2: Counter to Applicant's argument in the first paragraph of page 11, the passage col. 2, line 67 – col. 3, l. 5 is not cited in the actual ground of rejection. Although examiner agrees there is a difference between different cycles and different stages, the physics of advantage for both is the same, i.e., a more gradual transfer of heat, with reference to the aforementioned first principles.

a.3: With regard to Applicant's argument in the second paragraph of page 11, said argument relies in an essential manner on a presumed constancy of the method of use, including all parameters, when the teaching by Nathenson et al is implemented. This is not reasonable: to make optimal use of an invention, one should find the optimum operational conditions given the device as a whole. In the underlying case, inclusion of a third circuit or cycle should enable a gentler drop in temperature between each pair of interacting cycles, or, alternatively allowing a higher temperature difference between ambient and reactor temperature.

a.4: With regard to the conclusion statement in the third paragraph of page 11, the rejection does not rely on the teaching by Griepentrog et al, but instead on Nathenson et al, to which reference is made.

b: Claim 19 rejected under 35 U.S.C. 112, First and Second Paragraph:

Applicant's arguments are persuasive only in as far as the consistency of the claimed subject matter is concerned: an entirely closed system can be pressure-*regulated* through a valve of the kind disclosed (valve 20 with pistons regulating pressure through causing changes in the volume), but pressure equalizing is in serious doubt. The control of pressure is limited by the change in volume of the total space available to first heat exchange and second heat exchange gases. Scrutiny of arguments with disclosure as provided by the original Specification, page 17, second paragraph, convince of the possibility to enable the invention through valves only for limited pressure differences between the first and second heat exchange gases. The invention as a whole must be enabled as claimed. While ranges for core temperature, and for first and secondary heat exchange gases are provided (in the Specification), no inclusion of said temperature ranges in the claim, nor of the necessary information on first and second heat exchange gas densities are provided, and hence the invention is not enabled in scope with the claim.

d: Rejection of Claim 11 under 35 USC 103(a): this claim has been substantially amended. In response examiner includes rejection and the response to argument with regard to claim 5, admittedly related to this claim (see Remarks/Arguments, page 12) by reference in their entirety.

e: Rejection of claim 19 under 35 U.S.C. 103(a) is being reconsidered in light of Applicant's comments on the valve also in connection with the rejection under 35 USC 112 discussed under b above.

f: Applicant's traverse of the withdrawal of claims 15 and 16, i.e., arguments for inclusion of claims 15 and 16 in the examination, are persuasive. Therefore, claims 5, 11 and 15-19 have been examined.

However, the substantially amended claim 11 was found not to be drawn to the invention as elected, because the only "fourth circuit" different from primary, second and tertiary circuits in the invention as recited through claim 11, i.e., as recited through "a moderate temperature heat exchanger having a first portion connected to the secondary circuit [9] for circulation of the second heat exchange fluid in the moderate temperature heat exchanger and a secondary portion connected to a fourth circuit different from the primary [6], secondary and tertiary circuits [10]" (primary circuit =6, secondary circuit = 9, and tertiary circuit =10) is contingent on the inclusion of by-pass circuit 9', being the only circuit additional to the first, second and third circuits; however, bypass circuit 9' is not part of the elected invention (see response filed 9/15/06 to restriction/election requirement mailed 3/24/06). Therefore, claim 11 has been withdrawn from consideration.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Johannes P Mondt/
Primary Examiner, Art Unit 3663